REMARKS/ARGUMENTS

Reconsideration of this application is requested. Claims 1-6 and 8-17 are in the case.

I. THE OBVIOUSNESS REJECTION

Claims 1-6 and 8-17 stand rejected under 35 U.S.C. §102(b) as allegedly unpatentable over U.S. Patent 4,339,509 to Dardi et al. (Dardi) in view of U.S. Patent 4,743,514 to Strangman. The rejection is respectfully traversed.

The invention as claimed is directed to a method of stabilizing adherence of a ceramic layer to a bond coat of a TBC system. The method consists essentially of incorporating silicon into the bond coat, maintaining cobalt present in the bond coat at a level of 1-5 wt%, and maintaining yttrium present in the bond coat at a level of 0.1-8 wt%.

As conceded on page 2 of the Action, Dardi fails to suggest the presence of cobalt in the range of 1-5%, as required by the invention as claimed. This deficiency is not cured by Strangman.

Strangman discloses a coating for protecting gas turbine components. While cobalt is broadly disclosed as being present in a range of 0-10%, it is clear from the disclosure at column 7, beginning at line 42 that cobalt is preferably present at "a **zero** or **trace** level" (column 6, line 18; emphasis added).

In addition, Strangman discloses that the coating is strengthened by tantalum and niobium. As disclosed at column 7, beginning at line 15 of Strangman, "Tantalum

or niobium additions in the coating strengthen the coating, and can alter its thermal expansion coefficient to more closely match that of the underlying substrate."

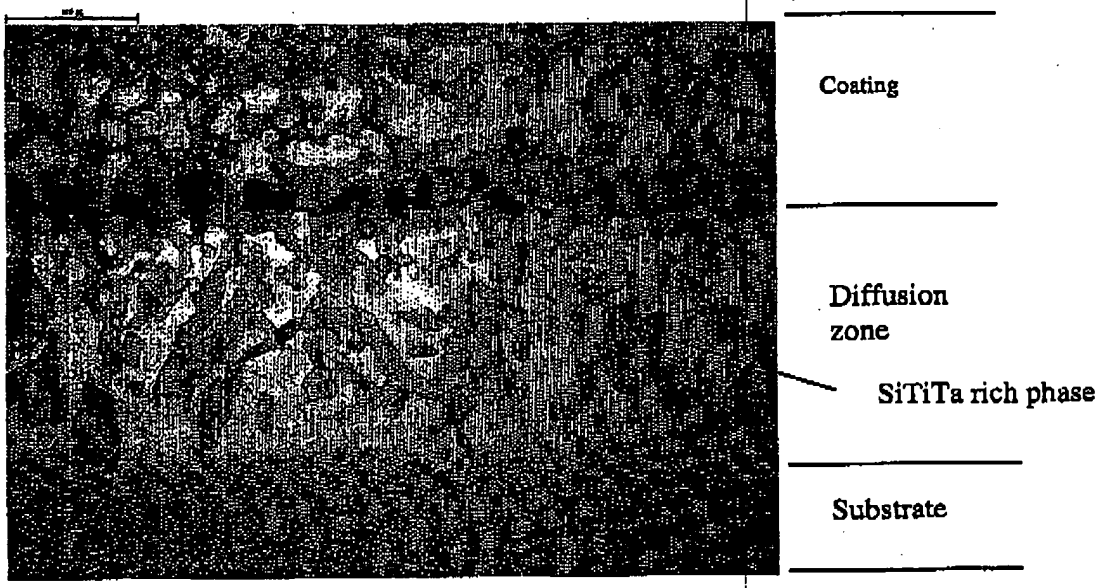
Thus, one of ordinary skill, upon reading Strangman, would have been motivated to **increase** the amount of tantalum present to enhance coating strength. However, according to the present invention, it has been discovered, surprisingly, that a detrimental effect occurs when tantalum is added to a **silicon**-containing bond coat. In this regard, attention is again directed to the Feng declaration with the microphotograph Exhibit (of record) showing that the co-presence of tantalum and silicon in interdiffusion zones of the coating causes formation of unwanted TaSi and TaTiSi intermetallic phases. These phases lead to a hardness increase, and embrittlement and spallation of the coating. Thus, addition of tantalum to **silicon**-containing bond coats causes early TBC failure, which is clearly undesired.

While Strangman broadly discloses tantalum in an amount of 0-10%, the preferred embodiments all contain increasing levels of tantalum. Indeed, Strangman discloses that the coating having the designation "SCC103" shown in Table I containing 7.0 % of tantalum "exhibited the best combination of oxidation resistance and diffusional stability of the coatings tested" (column 9, lines 36-38). Based on Strangman, therefore, the person of ordinary skill would have been motivated to include increasing amounts of tantalum to obtain a coating exhibiting superior oxidation resistance and diffusional stability.

However, increasing the amount of tantalum in the present invention leads to the deleterious formation of unwanted TaSi and TaTiSi intermetallic phases, which result in increases in hardness, and embrittlement and spallation of the coating. As claimed, the

present method consists essentially of incorporating silicon into the bond coat, maintaining cobalt present in the bond coat at a level of 1-5 wt% and maintaining yttrium present in the bond coat at a level of 0.1-8 wt%. The "consisting essentially of" language excludes the presence of deleterious amounts of tantalum which would otherwise cause unwanted hardness increases and embrittlement/spallation in the presence of silicon. The following example further illustrates why addition of Ta to the coating is detrimental.

As shown in the microphotograph below, after long-term exposure, a light gray phase formed in the diffusion zone. This phase contains 10 wt% Si, 13 wt% Ti and 16 wt% Ta with balance of primarily Nickel. The formation of this phase reduces the amount of Si in the matrix of coating, and thus is detrimental to oxidation resistance. Furthermore, investigations by the inventors have revealed that this phase causes embrittlement and coating spallation during the thermal exposure. Dardi and Strangman did not appreciate this important phenomenon.



NiCrAlY Coating with 3 wt% Si addition on substrate of GTD-111 alloy with 3 wt% Ta and 5 wt% Ti after 500 hours thermal exposure at 1900F.

In addition to the above, in order to realize the benefit of the presence of Si in the coating, the Si is desirably present in atomic form in a solid solution, and uniformly distributed through the coating. This is discussed in paragraph [0015] on page 5 of the application, where it is indicated that the silicon is applied as a continuous layer, typically under thermally grown oxide (TGO). The presence of silicon in this form reduces the diffusion rate of oxygen and sulfur ions, and consequently improves the coating life.

Based on the above, it is believed that a person of ordinary skill would not have been motivated to arrive at the presently claimed invention based on the combined disclosures of Dardi and Strangman, because Strangman suggests the addition of tantalum, an element which is clearly deleterious in the context of a silicon-containing bond coat system of the present invention. A *prima facie* case of obviousness has not therefore been established in this case. Withdrawal of the obviousness rejection is respectfully requested.

II. CLAIM AMENDMENTS

Claim 1 has been amended to improve its form as a method claim. No new matter is entered.

FENG et al
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Favorable action on this application is awaited.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: _____
Leonard C. Mitchard
Reg. No. 29,009

LCM:lfm
901 North Glebe Road, 11th Floor
Arlington, VA 22203-1808
Telephone: (703) 816-4000
Facsimile: (703) 816-4100